WHAT IS CLAIMED IS:

1. A method of impressing voltages on electrodes of an electron tube device mounted with a cold cathode, having an electron gun and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate electrode and an accelerating electrode, said method comprising the steps of:

impressing voltage Va which satisfies the following expression on said accelerating electrode,

$$Ib < P\mu \times Va^{3/2}$$

when a beam current emitted from said cold cathode by impressing voltage on said gate electrode is denoted as Ib, and a perveance of an electron gun to be determined according to a form of said electron gun is denoted as $P\mu$; and

impressing required voltages on said cold cathode, gate electrode, and collector electrode, respectively.

2. A method of impressing voltages on electrodes of a traveling wave tube device mounted with a cold cathode, having an electron gun, a slow wave circuit and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate

electrode, a Wehnelt electrode, an accelerating electrode and an ion trap electrode, said method comprising the steps of:

impressing voltage Va which satisfies the following expression on said accelerating electrode,

$$Ib < P\mu \times Va^{3/2}$$

when a beam current emitted from said cold cathode by impressing voltage on said gate electrode is denoted as Ib, and a perveance of the electron gun to be determined according to a form of said electron gun is denoted as P μ; and

impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, ion trap electrode, slow wave circuit and collector electrode, respectively.

3. A method of impressing voltages on electrodes of an electron tube device mounted with a cold cathode, having an electron gun and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a Wehnelt electrode, a gate electrode and an accelerating electrode, said method comprising the steps of:

impressing required voltages on said cold cathode, Wehnelt electrode, gate electrode, accelerating electrode and collector electrode, respectively, and maintaining

the difference between the electric potential of said Wehnelt electrode and the electric potential of said gate electrode at a constant value.

4. A method of impressing voltages on electrodes of a traveling wave tube device mounted with a cold cathode, having an electron gun, a slow wave circuit and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate electrode, a Wehnelt electrode, an accelerating electrode and an ion trap electrode, said method comprising the steps of:

impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, accelerating electrode, ion trap electrode, slow wave circuit and collector electrode, respectively, and maintaining the difference between the electric potential of said Wehnelt electrode and the electric potential of said gate electrode at a constant value.

5. A method of impressing voltages on electrodes of an electron tube device mounted with a cold cathode, having an electron gun and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate electrode and an accelerating electrode, said method comprising the steps

of:

impressing required voltages on said cold cathode, gate electrode and collector electrode, respectively, and impressing on the accelerating electrode the highest voltage of said respective electrodes at all times including the operation time, the rise time, the fall time and the time of abnormal operation of said device.

6. A method of impressing voltages on electrodes of an electron tube device mounted with a cold cathode, having an electron gun and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate electrode, an accelerating electrode and an electrode disposed adjacent to said accelerating electrode, said method comprising the steps of:

impressing a required voltage on said accelerating electrode;

impressing required voltages on said cold cathode, gate electrode, electrode adjacent to said accelerating electrode and collector electrode, respectively and concurrently impressing on the electrode disposed adjacent to said accelerating electrode the highest voltage of said respective electrodes at all times including the operation time, the rise time, the fall time and the time of abnormal operation of said device.

7. A method of impressing voltages on electrodes of a traveling wave tube device mounted with a cold cathode, having an electron gun, a slow wave circuit and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate electrode, a Wehnelt electrode, an accelerating electrode and an ion trap electrode, said method comprising the steps of:

impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, ion trap electrode, slow wave circuit and collector electrode, respectively, and impressing on the accelerating electrode the highest voltage among said respective electrodes at all times including the operation time, the rise time, the fall time and the time of abnormal operation of said device.

8. A method of impressing voltages on electrodes of an electron tube device mounted with a cold cathode, having an electron gun and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate electrode, and an accelerating electrode, said method comprising the steps of:

impressing required voltages on said cold cathode, gate electrode, accelerating electrode and said collector electrode, respectively, and finally impressing the gate

electrode voltage at the rise time of said device and first shutting off the gate electrode voltage at the fall time of said device.

9. A method of impressing voltages on electrodes of a traveling wave tube device mounted with a cold cathode, having an electron gun, a slow wave circuit and a collector electrode, said electron gun including a cold cathode provided with an array of field emitters, a gate electrode, a Wehnelt electrode, an accelerating electrode and an ion trap electrode, said method comprising the step of:

impressing required voltages on said cold cathode, gate electrode, accelerating electrode, Wehnelt electrode, ion trap electrode, slow wave circuit, and said collector electrode, respectively, and finally impressing the gate electrode voltage at the rise time of said device and first shutting off the gate electrode voltage at the fall time of said device.

10. An electron tube device mounted with a cold cathode

comprising:

an electron gun having a cold cathode for emitting an electron beam from an array of field emitters, a gate electrode and an accelerating electrode;

a collector electrode; and

a power supply unit for impressing required voltages on said cold cathode, gate electrode and collector electrode, respectively, and impressing voltage Va which satisfies the following expression on said accelerating electrode,

$$Ib < P\mu \times Va^{3/2}$$

when a beam current emitted from said cold cathode by impressing voltages on said gate electrode is denoted as Ib, and a perveance of said electron gun to be determined according to a form of said electron gun is denoted as $P\mu$.

11. A traveling wave tube device mounted with a cold cathode comprising:

an electron gun having a cold cathode for an emitting electron beam from an array of field emitters, a gate electrode, a Wehnelt electrode, an accelerating electrode and an ion trap electrode;

a slow wave circuit;

a collector electrode; and

a power supply unit for impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, ion trap electrode, slow wave circuit and

collector electrode, respectively, and impressing voltage Va which satisfies the following expression on said accelerating electrode,

$$Ib < P\mu \times Va^{3/2}$$

when a beam current emitted from said cold cathode by impressing voltages on said gate electrode is denoted as Ib, and a perveance of said electron gun to be determined according to a form of said electron gun is denoted as P μ.

12. An electron tube device mounted with a cold cathode comprising:

an electron gun having a cold cathode for an emitting electron beam from an array of field emitters, a Wehnelt electrode, a gate electrode and an accelerating electrode;

a collector electrode; and

a power supply unit for impressing required voltages on said cold cathode, Wehnelt electrode, gate electrode, accelerating electrode and collector electrode, respectively, and controlling to maintain the difference between the electric potential of said Wehnelt electrode and the electric potential of said gate electrode at a constant value.

13. A traveling wave tube device mounted with a cold cathode comprising:

an electron gun having a cold cathode for emitting electron beams from an array of field emitters, a Wehnelt electrode, a gate electrode, an accelerating electrode and an ion trap electrode;

a slow wave circuit;

a collector electrode; and

a power supply unit for impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, accelerating electrode, ion trap electrode, slow wave circuit and collector electrode, respectively, and maintaining the difference between the electric potential of said Wehnelt electrode and the electric potential of said gate electrode at a constant value.

14. An electron tube device mounted with a cold cathode comprising:

an electron gun including a cold cathode for emitting an electron beam from an array of field emitters, a gate electrode and an accelerating electrode;

a collector electrode;

a power supply unit for impressing required voltages on said cold cathode, gate electrode and collector electrode, respectively, and impressing on said accelerating electrode the highest voltage of said

respective electrodes at all times including the operation time, the rise time, the fall time and the time of abnormal operation of said device.

15. An electron tube device mounted with a cold cathode comprising:

an electron gun including a cold cathode for emitting an electron beam from an array of field emitters, a gate electrode and an accelerating electrode;

a collector electrode;

a power supply unit for impressing required voltages on said cold cathode, accelerating electrode, gate electrode and collector electrode, respectively, and impressing the highest voltage of said respective electrodes on the electrode in said respective electrodes which is disposed adjacent to said accelerating electrode at all times including the operation time, the rise time, the fall time and the time of abnormal operation of said device.

16. A traveling wave tube device mounted with a cold cathode comprising:

an electron gun including a cold cathode for an emitting electron beam from an array of field emitters, a gate electrode, a Wehnelt electrode, an accelerating electrode and an ion trap electrode;

a slow wave circuit;

a collector electrode;

a power supply unit for impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, ion trap electrode, slow wave circuit and said collector electrode, respectively, and impressing on said accelerating electrode the highest voltage among said respective electrodes at all times including the operation time, the rise time, the fall time and the time of abnormal operation of said device.

17. An electron tube device mounted with a cold cathode comprising:

an electron gun including a cold cathode for emitting an electron beam from an array of field emitters, a gate electrode and an accelerating electrode;

a collector electrode;

a power supply unit for impressing required voltages on said cold cathode, gate electrode, accelerating electrode and collector electrode, respectively, and finally impressing the gate electrode voltage at the rise time of said device and first shutting off the gate electrode voltage at the fall time of said device.

18. A traveling wave tube device mounted with a cold cathode comprising:

an electron gun including a cold cathode for emitting an electron beam from an array of field emitters, a gate electrode, a Wehnelt electrode, an accelerating electrode and an ion trap electrode;

a slow wave circuit;

a collector electrode;

a power supply unit for impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, ion trap electrode, slow wave circuit and collector electrode, respectively, and finally impressing the gate electrode voltage at the rise time of said device and first shutting off the gate electrode voltage at the fall time of said device.

19. An electron tube device mounted with a cold cathode comprising:

an electron gun including a cold cathode for emitting an electron beam from an array of field emitters, a gate electrode and an accelerating electrode;

a collector electrode;

a plurality of power supply units for impressing required voltages on said cold cathode, gate electrode, accelerating electrode and collector electrode, respectively, wherein

the power supply unit among said plurality of power supply units which is connected to the electrode on which the highest electric potential is impressed has a larger voltage drop time constant at the time of power supply stop when compared to other power supply units connected to other electrodes.

20. An electron tube device mounted with a cold cathode according to claim 19, wherein the power supply unit connected to said electrode on which the highest electric potential is impressed is composed of a DC source and a capacitor, said DC source and said capacitor being connected in parallel.

21. An electron tube device mounted with a cold cathode according to claim 19, wherein the power supply unit connected to said electrode on which the highest electric potential is impressed is composed of a DC source and a coil, said coil being connected in series to an output side of an anode of said DC source.

22. A traveling wave tube device mounted with a cold cathode comprising:

an electron gun including a cold cathode for emitting electron beam currents from an array of field emitters, a gate electrode, an Wehnelt electrode, an

accelerating electrode and an ion trap electrode;

a slow wave circuit

a collector electrode;

a plurality of power supply units for impressing required voltages on said cold cathode, gate electrode, Wehnelt electrode, accelerating electrode, ion trap electrode, slow wave circuit and collector electrode, respectively, wherein

the power supply unit of said plurality of power supply units connected to the electrode on which the highest electric potential is impressed has a larger voltage drop time constant at the time of power supply stop when compared to other power supply units connected to other electrodes.

23. A traveling wave tube device mounted with a cold cathode according to claim 22, wherein the power supply unit connected to said electrode on which the highest voltage is impressed is composed of a DC source and a capacitor, said DC source and said capacitor being connected in parallel.

24. A traveling wave tube device mounted with a cold cathode according to claim 22, wherein the power supply unit connected to said electrode on which the highest voltage is impressed is composed of a DC source

and a coil, said coil being connected in series to an output side of an anode of said DC source.